REMARKS

Claims 1 and 3-27 are pending in the present application. The rejections under 35 U.S.C. 102 and 35 U.S.C. 103 are respectfully traversed for the reasons stated herein. Applicants believe that the present application is in condition for allowance of which prompt and favorable action is respectfully requested.

35 U.S. C. 102 Rejection

Claims 1, 3-8, 12-27 were rejected under 35 U.S.C. 102(e) as being anticipated by Narasimhan (US 7,016,651). Applicants respectfully traverse this rejection for the reasons stated below. The MPEP recited the standard to be applied in an issue of anticipation under 35 USC 102. Section 2131 of the MPEP states in part:

TO ANTICIPATE A CLAIM, THE REFERENCE MUST TEACH EVERY ELEMENT OF THE CLAIM

> "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987)."
>
> "The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). *See also* MPEP § 2131."

On page 2 of the Office Action, the Examiner provides a response to Applicants' arguments filed on March 22, 2010 and stated the following:

> "Narasimhan teaches determining signal to noise ratio. Signal to noise ratio (SNR) determines noise that is encountered with respect to the signal to be used for communication. <u>This noise is from other idle sub-carrier frequency band which is not used for communicating signals.</u> <u>In determining SNR you are determining the noise of the other idle sub-carrier frequency band.</u> The noise determined is the amount of noise and interference present from other sub-carrier frequency band that is interfering with the current signal which is to be used for

> communication. Therefore, by calculating SNR the noise and interference of the idle sub-carrier band is determined." *Office Action dated 06/10/2010, page 2 (emphasis added).*

Applicants thank the Examiner for sharing his view of cited reference Narasimhan. The Examiner correctly noted that Narasimhan teaches determining the signal to noise ratio. However, Applicants respectfully disagree with the characterization of Narasimhan in view of the pending claims. Applicants present two points for further consideration: 1) the issue that Narasimhan does not disclose computing only noise and interference and 2) the lack of an idle sub-carrier in Narasimhan.

Regarding Computing **Only** Noise and Interference

This specific description of $N_{n,k}$ in Narasimhan is in contrary to the Office Action's characterization of Narasimhan, which constitutes the basis for the 102 rejection of the pending claims. In particular, the Office Action states "[i]n determining SNR you are determining the noise of the other idle sub-carrier frequency band" (emphasis added), which inherently implies that Narasimhan teaches the existence of an idle sub-carrier frequency band. However, as the description of $N_{n,k}$ suggests (*see Narasimhan, col. 5, lines 49-60*), the noise is "present in the kth sub-carrier or tone during transmission of the nth OFDM symbol" (emphasis added), which teaches that an OFDM symbol is transmitted in the nth symbol slot. Thus, the nth sub-carrier frequency band is occupied or assigned and not idle.

Applicants' assertion that an idle sub-carrier frequency band is not disclosed in Narasimhan is further supported by the Narasimhan's own word. Narasimhan teaches employing 52 subcarriers, which is consistent with IEEE 802.11a/g standards (*see Narasimhan, col. 5, lines 25-26*). Narasimhan also teaches that for the 802.11a/g standards, "there are up to 52 defined sub-carriers or tones, of which 48 are available to

carry data (the 4 remaining are pilot sub-carriers or tones, which bear predetermined data)" (*see Narasimhan, col. 1, lines 48-51*). Since 48 sub-carriers are available to carry data and 4 sub-carriers are for pilot data, from a total of 52 subcarriers, this clearly states that all the subcarriers are carrying symbols, and they are not just only noise and interference. Narasimhan does not teach idle sub-carriers that carry no data and only noise and interference as recited in the pending claims.

As pointed out by Applicants in the previously submitted Amendments, Applicants respectfully disagree with the assertion that Narasimhan teaches the claim element of detecting or determining received power in an idle sub-carrier frequency band wherein the idle sub-carrier frequency band includes only noise and interference. To further prosecution of the pending claims, in a previously submitted Amendment, Applicants amended the claims to recite the element of "detecting a received power in an idle sub-carrier frequency band, wherein the idle sub-carrier frequency band includes only noise and interference" in claim 1; the element of "determining an idle sub-carrier frequency band during the symbol period, wherein the idle sub-carrier frequency band includes only noise and interference" in claims 14 and 27; the element of "to determine an idle sub-carrier frequency band during the OFDM symbol period wherein the idle sub-carrier frequency band includes only noise and interference" in claim 15; and the element of "determining an idle sub-carrier frequency band during the OFDM symbol period wherein the idle sub-carrier frequency band includes only noise and interference" in claim 21. These elements explicitly recite that "the idle sub-carrier frequency band includes only noise and interference," that is, there is no signal present.

As stated in a previously submitted Amendment, the feature of the idle sub-carrier frequency band is found in paragraphs 0014, 0043, 0053, 0057-0058 of US2005/0002324 (published version of the -present application). In particular, paragraph 0058 defines the idle sub-carrier to include only noise and interference as recited in the pending claims. Moreover, paragraph 0060 discloses that the detected power of an unassigned sub-carrier either represents aggregate noise and interference for that sub-carrier band or represents detected power of the noise floor if no interfering sources are found in the sub-carrier band. Thus, in either case, the unassigned or idle sub-carrier contains no signal power component, only noise and interference power components.

For example, in the previously submitted Response dated September 24, 2009, Applicants provided an explanation as to why cited reference Narasimhan does not teach the recited elements of the pending claims. Portions of the previous explanation are repeated herein. Additionally, Applicants respectfully offer additional explanation regarding a soft decision and a hard decision.

Narasimhan performs SNR estimation based on both hard decision and soft decision outputs. Further background explanation is provided here to show that <u>a signal must be present for a soft or hard decision to be made</u>. It is well known in the digital communications art that the fundamental difference between hard decision and soft decision outputs is the degree of quantization provided for each symbol decision when a signal is present, i.e., not idle. Simply put, a hard decision yields a single bit level (i.e. zero or one) of quantization for the decoder output for each symbol. A hard decision may be interpreted as having only sign information, that is, whether the symbol is above or

below a single threshold. The symbol is equivalent to a signal and is not only noise and interference.

A soft decision yields multiple bit levels of quantization for the decoder output for each symbol. A soft decision may be interpreted as having both sign and magnitude information, that is, whether the symbol is above or below a threshold and how much the symbol magnitude (independent of sign) is away from that threshold. Again, the symbol is part of a signal and is not only noise and interference. The soft decision thus provides a measure of the decision reliability or confidence level (how sure we are of the symbol decision).

The explanation above regarding hard and soft decision is found, for example, in Sklar, Digital Communications, 2nd edition, 2001, (attached as Exhibit A) which explains hard and soft decisions as follows:

> "Since the demodulator output consists of the discrete elements 0 and 1, the demodulator is said to make a firm or hard decision on each symbol...When such hard decisions are used in a binary coded system, the demodulator feeds, the two-valued code symbols or channel bits to the decoder. Since the decoder then operates on the hard decisions made by the demodulator, decoding with a BSC channel is called hard-decision decoding." *Sklar, p. 319*

Sklar states that the demodulator output consists of a finite set of signal choices (i.e., discrete elements 0 and 1), none of which includes the choice of an idle signal, or sub-carrier. And, the decision (for example, hard decision as quoted in Sklar above) is based on the signal choices.

> "When the demodulator output consists of a continuous alphabet or its quantized approximation (with greater than two quantization levels), the demodulator is said to make soft decisions. In the case of a coded system, the demodulator feeds such quantized code symbols to the decoder…" *Sklar, p. 319*

Sklar states that the demodulator output is selected from a finite set of signal choices (i.e., an alphabet), none of which includes the choice of an idle signal, or sub-carrier. And, the decision (for example, soft decision as quoted in Sklar above) is based on the signal choices.

Furthermore, Sklar describes the decision process in a communications receiver as trying to decide which one of the signals is actually being transmitted:

> "The detector's task after receiving **r** is to decide which of the signals ($\mathbf{s}_1$ or $\mathbf{s}_2$) was actually transmitted. The method is usually to decide on the signal classification that yields the minimum expected P_E, although other strategies are possible…This rule is often stated in terms of decision regions…" *Sklar, p. 177*

Thus, as explained by Sklar, the decision process (whether a soft or a hard decision) in a digital communications receiver is a selection process among a finite signal set. This means that a signal must be present for a decision to be made. That is, there is no concept of an idle subcarrier (a.k.a. idle signal) in the concept of signal decision such as in either a hard decision or a soft decision. This requirement for a signal from a finite signal set is true also for the particular cases of hard decisions and soft decisions, where the only fundamental distinction between them is the form of the decision output, namely single bit (for hard decision) and multiple bits (for soft decision) and not a question of whether there is a signal present or not. Both hard and soft decisions require a signal present for the decision to be made.

Therefore, Narasimhan defines an SNR estimation technique by his equation (7) as a function of the difference between $X'_{n,k}$ and $K_{mod}\,D_{n,k}$ where

> "$X'_{n,k}$ represents the soft decision generated by the FEQ (sic) 220, and $D_{n,k}$ represents the hard decision generated by the slicer 225, for the kth sub-carrier of the nth OFDM symbol of the received PLCP frame…" *Narasimhan, col. 7, lines 30-34.*

In other words, the SNR estimation technique in Narasimhan relies on soft and hard decisions, which as explained in the quoted passages in Sklar, must include the presence of a signal for the soft or hard decision to be made. Based on this, Narasimhan does not teach the elements of the pending claims since Narasimhan relies on a function of soft and hard decisions to estimate the SNR, where the decisions require a signal to be present in contrast to the idle subcarriers as recited in the pending claims.

To reiterate, Narasimhan teaches "techniques employ a link interface receiving OFDM symbol(s) from the link, and a signal-to-noise ratio (SNR) estimation unit generating an estimate of a geometric SNR (SNR_{geo}) for the received symbols based on an average of the logarithmic difference between soft decision and hard decisions for the received symbol." *Narasimhan (US 7,016,651), Abstract.*

The Office Action on page 3 stated that the Abstract of Narasimhan discloses the element of "determining SNR determines power of idle sub-carrier where you determine power of noise in the signal-to-noise ratio." Applicants respectfully disagree with this characterization of Narasimhan for the following reasons. Narasimhan does not disclose the concept of measuring the signal-to-noise ratio by separately measuring the power of noise in perhaps an idle sub-carrier. And, Narasimhan does not mention the concept of either "an idle sub-carrier" or "an unassigned sub-carrier" in the abstract or in the specification. Thus, the interpretation that Narasimhan determines the power of noise in an idle sub-carrier is unsupported because Narasimhan does not even discuss the concept of an idle sub-carrier.

Narasimhan in Col 8, lines 17-47, which is cited in the Office Action on page 2, states:

"For example, assume in an 802.11a/g OFDM system, a subset of sub-carriers are [sic] selected from a set of sub-carriers. If K=8, meaning that a subset of 8 sub-carriers are used to estimate $SNR_{geo,n}$' a possible regularly spaced subset could include sub-carriers {1, 8, 15, 22, 29, 36, 43, 50} for the nth OFDM symbol in the received frame. Thus, in this case, every 7th sub-carrier is selected for averaging. For the next OFDM symbol n+l, this subset could remain the same, or alternatively, a different subset, partially or fully distinct from the previous subset, may be selected, such as {2, 9, 16, 23, 30, 37, 44, 51}. Of course, this represents only a possible selection strategy to achieve an acceptable SNR_{geo} estimate, either in isolation or over a number of received OFDM symbols or frames, and in fact other selection strategies may be implemented consistent with the present invention as long as a sufficient number of sub-carriers are chosen to provide a representative subset of the symbol constellation. With consideration given to such sub-carrier subset selection, equation (8) becomes:

$$SNR_{geo,n,dB} \approx \mathrm{Avg}_k\left[-20\log_{10}\left|\frac{Y_{n,k}}{H'_{n,k}} - K_{mod}D_{n,k}\right|\right], \qquad (9)$$

$$k = \kappa_0, \kappa_1, \ldots, \kappa_{K-1}, K \leq N.$$

This relationship can be conveniently implemented by the SNR estimation unit 235 shown in FIG. 2 to provide an SNR estimate, and consequently a measure of signal quality 5Q on a per received OFDM symbol basis."

As shown in the quotation, Narasimhan teaches using subcarriers for SNR estimation where each has a signal used for decisions. This is in contrast to the pending claims which recite an "idle sub-carrier frequency band" and which define that the "idle sub-carrier frequency band includes only noise and interference" void of a signal component.

More specifically, Narasimhan explicitly teaches an SNR estimation technique in his equation (7) as a function of soft decision outputs $X'_{n,k}$ and hard decision outputs $D_{n,k}$. It is known by one skilled in the art that soft decision outputs are produced by a symbol detector with a multiple bit output when a digital signal is present at the input. Similarly, hard decision outputs are produced by a symbol detector with a single bit output when a digital signal is present at the input. To put it another way, if there is only noise (i.e.,

void of signal), there would be no need for a decision (either a soft decision or a hard decision) to be made. In Narasimhan, the term "symbol" represents a signal.

In either the soft decision or hard decision case, a signal (in addition to noise and interference) is presented to the symbol detector to make a definitive decision on the digital state of the signal (e.g., a zero state or a one state). For example, this notion can be seen by examining the assumptions stated in Narasimhan in Col. 7, lines 7-27 where a transmitted symbol (i.e. signal) X_k is explicitly postulated in the formulation of equations (4) and (5). In equation (4) the signal component is represented by X_k for a soft decision of a postulated signal. This signal component is then approximated by the $K_{mod}D_{n,k}$ term for a hard decision of a postulated signal in equation (5).

Moreover, as Narasimhan provides further simplifications to his SNR estimation through equations (7) through (9) with each equation preserving the term $K_{mod}D_{n,k}$, and thus, the estimated SNR again depends on a function of soft decisions and hard decisions of a postulated signal. That is, Narasimhan discloses the estimation of SNR using soft decisions and hard decisions across a plurality of non-idle sub-carriers. Narasimhan states this explicitly in the Abstract "Techniques for measuring signal quality in a communications link supporting OFDM symbol transfer across plural sub-carriers are disclosed." To characterize that Narasimhan discloses power estimation of an idle sub-carrier frequency band (i.e. without a signal present) is contrary to what Narasimhan explicitly states.

Thus, for the reasons stated above, Narasimhan fails to teach the elements of the claims and no *prima face* case of anticipation can be supported. And, withdrawal of the 35 U.S.C. 102 rejection is respectfully requested.

35 U.S. C. 103 Rejection

Dependent claim 9 was rejected under 35 U.S.C. 103(a) as being unpatentable over Narasimhan (US 7,016,651) in view of Vella-Coleiro (US 7,197,085). Dependent claim 10 was rejected under 35 U.S.C. 103(a) as being unpatentable over Narasimhan (US 7,016,651) in view of Jones et al. (US 6,757,241). Dependent claim 11 was rejected under 35 U.S.C. 103(a) as being unpatentable over Narasimhan (US 7,016,651) in view of Jones et al. (US 6,757,241) and further in view of Crawford (US 6,549,561).

The MPEP recited the standard to be applied in an issue of obviousness under 35 USC 103. Section 2143.03 of the MPEP states in part:

ALL CLAIM LIMITATIONS MUST BE CONSIDERED

> "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

The factual inquiries that are relevant in the determination of obviousness are determining the scope and contents of the prior art, ascertaining the differences between the prior art and the claims in issue, resolving the level of ordinary skill in the art, and evaluating evidence of secondary consideration. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 2007 U.S. LEXIS 4745, at **4-5 (2007) (citing Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 17-18 (1966)). To establish a *prima facie* case of obviousness, the prior art references "must teach or suggest all the claim limitations." M.P.E.P. § 2142. As the Board of Patent Appeals and Interferences has confirmed, "obviousness requires a suggestion of all limitations in a claim." In re Wada and Murphy, Appeal 2007-3733 (citing CFMT, Inc. v. Yieldup Intern. Corp., 349 F.3d 1333, 1342 (Fed. Cir.

2003)). Moreover, the analysis in support of an obviousness rejection "should be made explicit." KSR, 2007 U.S. LEXIS 4745, at **37. "[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." Id. (citing In re Kahn, 441 F.3d 977, 988 (Fed. Cir. 2006)).

Dependent claims 9, 10 and 11 each depend from independent claim 1, and as such, each also recites the elements of claim 1. The cited secondary references (Vella-Coleiro, Jones and Crawford), however, do not make up for the deficiency of Narasimhan.

As stated on page 9 of the Office Action, Vella-Coleiro is cited for disclosing "determining a sum of a square of a quadrature component with a square of an in-phase component." On page 10 of the Office Action, it is stated that based on Jones it would be obvious "to store the detected receive power as a noise plus interference estimate if the sub-carrier frequency is being used and only storing noise if the sub-carrier frequency band is not used since in the absence of interference only noise is present." And, on page 10 of the Office Action, Crawford is cited for disclosing "synchronizing a time reference with a transmitter transmitting the OFDM symbols."

Thus, assuming we take the characterization of the cited secondary references for what are stated above, the cited secondary references, either taken separately or in combination with each other or with Narasimhan, do not disclose, teach, suggest or make obvious all of the features of dependent claims 9, 10 and 11, and the 103 rejection should be withdrawn accordingly.

CONCLUSION

For the reasons stated above, the prior art references cited in the Office Action do not anticipate, teach, disclose, suggest or make obvious the pending claims 1 and 3-27. Thus, Applicants respectfully request withdrawal of the 35 U.S.C. 102 and 35 U.S.C.103 rejections based thereon.

REQUEST FOR ALLOWANCE

In view of the foregoing, Applicants submit that all pending claims in the application are patentable. Accordingly, reconsideration and allowance of this application are earnestly solicited. The Commissioner is authorized to charge Deposit Account No. 17-0026 for the fees owed for the Request for Continued Examination (RCE). Applicants do not believe that any other fees are due regarding this Response. However, if any other fees are required, please charge Deposit Account No. 17-0026. Applicants encourage the Examiner to telephone the Applicants' attorney should any issues remain.

Respectfully submitted,

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